THE EFFECTS OF ELECTROMAGNETIC FIELDS ON VIBRIO VULNIFICUS/PARAHAEMOLYTICUS IN OYSTERS

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Vibrio vulnificus, commonly found in coastal waters, is a bacterium responsible for 149 serious illnesses resulting in 75 deaths between 1989 and 1996 according to the Centers for Disease Control and Prevention (CDC). Each year in the United States, Vibrio also causes an estimated 8000 infections. Vibrio bacteria are found naturally in coastal waters and are not related to pollution. Although one can get infected in the water through open cuts or wounds, generally fatal cases are related to raw oysters, clams or other shellfish consumption. Oysters filter Vibrios from seawater, where they are ubiquitous, although not always in high abundance, nor always a pathogenic strain. As a result, the bacteria will appear in the pallial cavity and are directed to the mouth and then into the gut where they will typically reach their highest concentrations. Thoroughly cooking will kill the bacteria but will also compromise the oyster. The goal of this study is to investigate the effects of electromagnetic fields on Vibrio vulnificus and Vibrio parahaemolyticus in oysters.

The analysis was performed using Finite Element Boundary Integral Method (FE-BI). Finite elements have been extensively used to model open- and closed- domain electromagnetic problems in scalar form in two and three dimensions. The derivation of the FE-BI equations begins with the vector wave equation. This second-order partial differential equation is solved by employing the Galerkin method to form a residual. The goal is to minimize this residual or equivalently to minimize the difference between the solution of the FE-BI discrete approximation and physical reality.

Through simulations, a 3-D volumetric field distribution map of the oyster was derived. The analysis was done using different sources for a wide range of frequencies. The results obtained during this study were aimed to help to determine the appropriate source, source location and frequency that will destroy the bacteria without compromising the oyster itself.

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2. K - Electromagnetics in Biology and Medecine

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4. C - Contributed Paper

5. No special instructions